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BEKASI-EAST JAKARTA AIRPORT
AIR SIDE

Report

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1.1 Location

The main influence on the airport location is the presence of other airports in the area. Since Jakarta has already one airport, the 18 th worldwide, the location has to be selected carefully. Other factors that influenced the airports final location were the ease to provide the airport with good connections to the city and a wide area available in order to increase the airports infrastructure if needed in the future. After considering all those factors, the location decided can be defined by the following coordinates:

- Latitude: 6°08'21"

- Longitude: 107°06'40"

- Altitude: 30meters approximately.

Since the area chosen is extremely marshy, the excavations to deeper levels are going to be avoided as much as possible due to its difficulties and cost. However, that type of terrain gives us some advantage due to its flatness.

1.2 Meteorology

1.2.1 Temperature

The reference temperature of airports is important to be calculated as soon as possible since it has an effect on the performance of the airplanes during the phases of landing and takeoff.

In order to calculate this temperature, the definition given by the OACI will be used. OACI states that: "The aerodrome reference temperature shall be the monthly mean of the daily maximum temperatures for the hottest month of the year (the hottest month being that which has the highest monthly mean temperature). This temperature shall be averaged over a period of years".

Taking into account the hypothesis that the temperatures obtained on Soekarno-Hatta Airport can also be used in order to calculate our reference temperature due to the fact that both airports are only separated by a distance of 60 km, a comparison study has been made.

The final reference temperature obtained is $T_{ref} = 32,38°C$.

The temperature values and study is further detailed in the attachments.

1.2.2 Wind

In order to calculate the influence of the winds the first thing done is the graph of the winds intensity and their direction. This graph is commonly called wind rose graph. The graph obtained making use of Microsoft Excel software is:

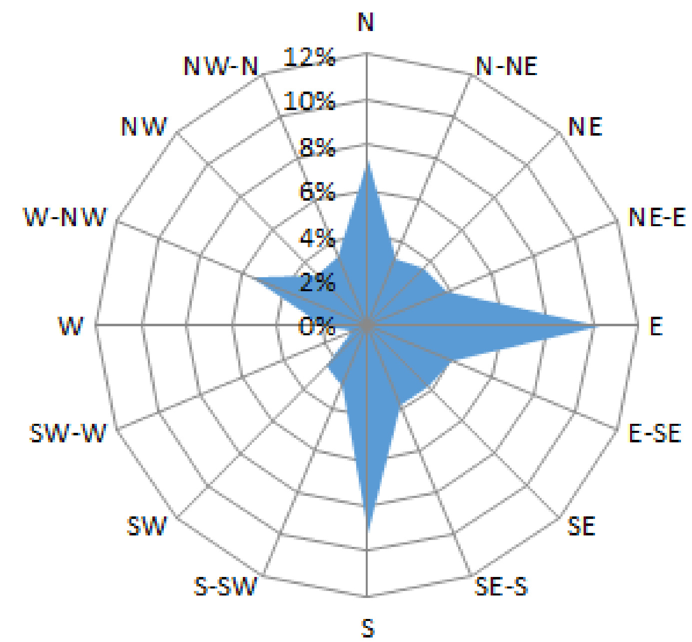

Figure 1.2.1: Wind Rose Graph

Once this step is done, the next thing to do is to calculate the coefficient of use by a diagram of frequencies. Following the recommendations given by the OACI on the attachment 14, the maximum value that the transversal component can achieve is 37km/h or 20 knots for a runway of >1500m.

The diagram of frequencies basically creates a rectangular area that depends on the runway axis, the width of the runway and the maximum transversal component.

After calculating the coefficient of use by all the directions, the graph obtained is the following:

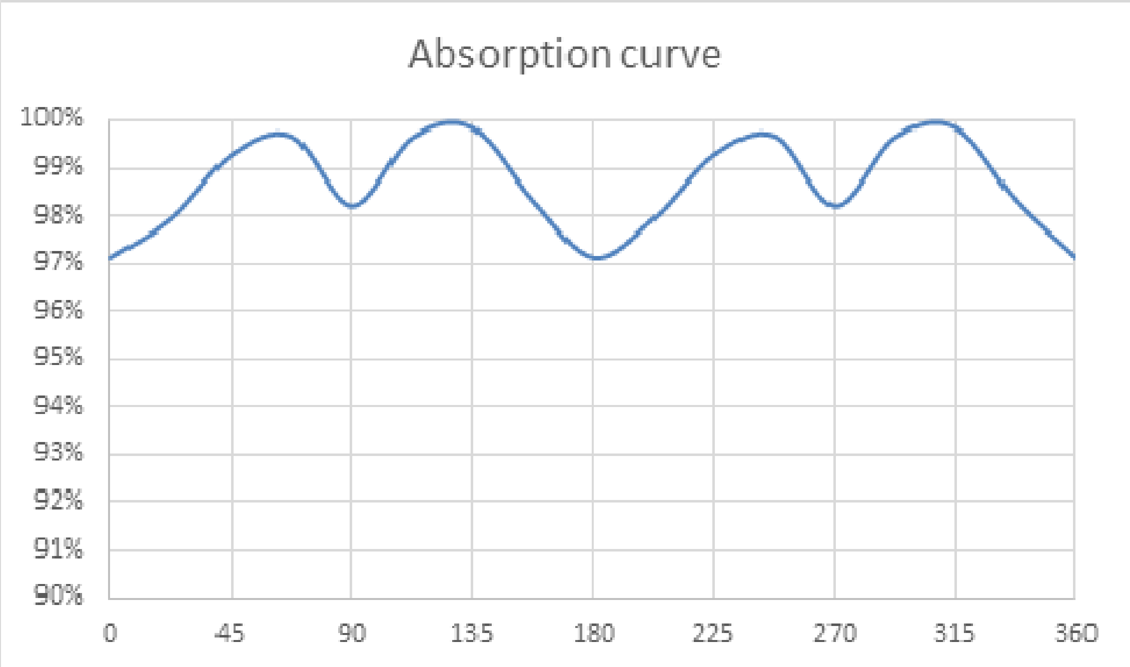

Figure 1.2.2: Coefficient of use depending on the orientation

As it can be see, the coefficient is higher than 95% in any direction. According to that, the final orientation chosen is SE-NW.

2 Runway design

2.1 Introduction

The runway is a key piece of the airport and the air side design due to the fact that defines the maximum dimensions of the operative airplanes. Its function is to successfully guarantee the landing and takeoff operation.

In order to successfully define the runway, the instructions and requirements given in the Annex 14 given by the OACI have been followed.

2.2 Runway Length

The reference field length is defined as the minimum length needed in order to perform a takeoff operation with the maximum homologated takeoff weight using sea level conditions, without wind and considering 0° slope.

In order to calculate the runway length, the first step is to choose the most restrictive airplane that is going to operate on that runway. Afterwards, that length has to be corrected by the runway slope, the altitude of the airport and the mean temperature.

Due to the fact that the airport has two runways, from now on, the runway used for international flights will be referred as runway 1 and the one used for domestic flights will be named runway 2.

2.2.1 Runway 1

The biggest airplanes that will operate on this runway are the Boeing 777-300ER and the Airbus A330-300.

2.2.1.1 Reference Field Length

Starting with the B777-300ER, using the ACAP (Aircraft Characteristic for Airport Planning), the values of the MTOW (Maximum TakeOff Weight) and MLW (Maximum Landing Weight) can be obtained.

2.1.1 General Characteristics: Model 777-200LR. -300ER, 777F

CHARACTERISTICS	UNITS	777-200LR	777-300ER	777-F
MAX DESIGN TAXI WEIGHT	POUNDS	768,000	777,000	768,800
	KILOGRAMS	348,358	352,442	348,722
MAX DESIGN TAKEOFF WEIGHT	POUNDS	766,000	775,000	766,800
	KILOGRAMS	347,452	351,535	347,815
MAX DESIGN LANDING WEIGHT	POUNDS	492,000	554,000	575,000
	KILOGRAMS	223,168	251,290	260,816
MAX DESIGN ZERO FUEL WEIGHT	POUNDS	461,000	524,000	547,000
	KILOGRAMS	209,106	237,683	248,115
OPERATING EMPTY WEIGHT (1)	POUNDS	320,000	370,000	318,300
	KILOGRAMS	145,150	167,829	144,379
MAX STRUCTURAL PAYLOAD	POUNDS	141,000	154,000	228,700
	KILOGRAMS	63,957	69,853	103,737
TYPICAL SEATING CAPACITY	TWO CLASS	279 (4)	339 (6)	N/A
	THREE CLASS	301 (5)	370 (7)	N/A
MAX CARGO --LOWER DECK	CUBIC FEET	5,656 (2)	7,552 (2)	22,371 (3)
	CUBIC METERS	160.2 (2)	213.8 (2)	633.5 (3)
USABLE FUEL	U.S. GALLONS	47,890	47,890	47,890
	LITERS	181,283	181,283	181,283
	POUNDS	320,863	320,863	320,863
	KILOGRAMS	145,538	145,538	145,538

Figure 2.2.1: Maximum weights of the B777 depending on its configuration.

The next step is to calculate using the following graph the takeoff distance required with standard day + 15ºC = 30ºC and sea level conditions.

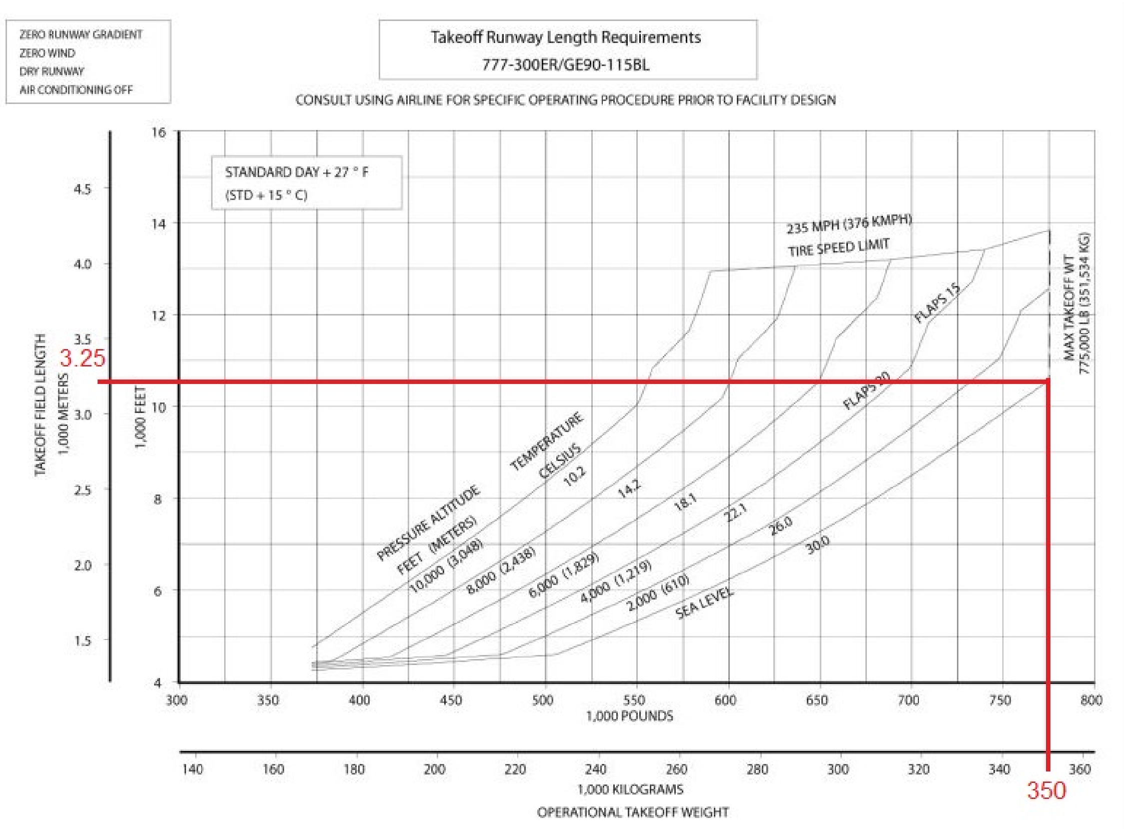

Figure 2.2.2: Relation between the MTOW and the takeoff distance.

As it is seen on the graph above, the length taken as reference (LCR) is 3.250m in a standard day+15ºC and sea level conditions.

The same procedure has to be done with the Airbus A330-300 in order to compare with one is the most restrictive one. Using the ACAP (Aircraft Characteristic for Airport Planning), the MTOW and MLW obtained are the following:

Aircraft Characteristics				
	WV000	WV001	WV002	WV003
Maximum Taxi Weight (MTW) Maximum Ramp Weight (MRW)	212 900 kg (469 364 lb)	184 900 kg (407 635 lb)	212 900 kg (469 364 lb)	215 900 kg (475 978 lb)
Maximum Take-Off Weight (MTOW)	212 000 kg (467 380 lb)	184 000 kg (405 650 lb)	212 000 kg (467 380 lb)	215 000 kg (473 994 lb)
Maximum Landing Weight (MLW)	174 000 kg (383 604 lb)	174 000 kg (383 604 lb)	177 000 kg (390 218 lb)	177 000 kg (390 218 lb)
Maximum Zero Fuel Weight (MZFW)	164 000 kg (361 558 lb)	164 000 kg (361 558 lb)	167 000 kg (368 172 lb)	167 000 kg (368 172 lb)

Figure 2.2.3: Maximum A330's weights.

Since the difference on the MTOW and MLW between both planes is greater than a 50%, the Boeing's Reference Field Length is chosen as the critical without calculating the Reference Field Length of the A330-300.

Once the most restrictive plane is chosen, the next step is to correct the length following OACI's instructions. The equation used to correct the altitude difference is:

$$L_t = RFL * (1 + 0,07 * \frac{\Delta h}{300})$$

Solving the equation for a RFL of 3.250m and an increase on the altitude of 100m, the result obtained is 3326m. Since the temperature has already been corrected on the graph and the runway slope is going to be less than 0,5% and thus, it can be neglected, the final length will be 3.500m rounding up.

2.2.1.2 Reference code

Using the dimensions of the B777-300ER and the tables given by the OACI, the number and letter that define the runway can be obtained.

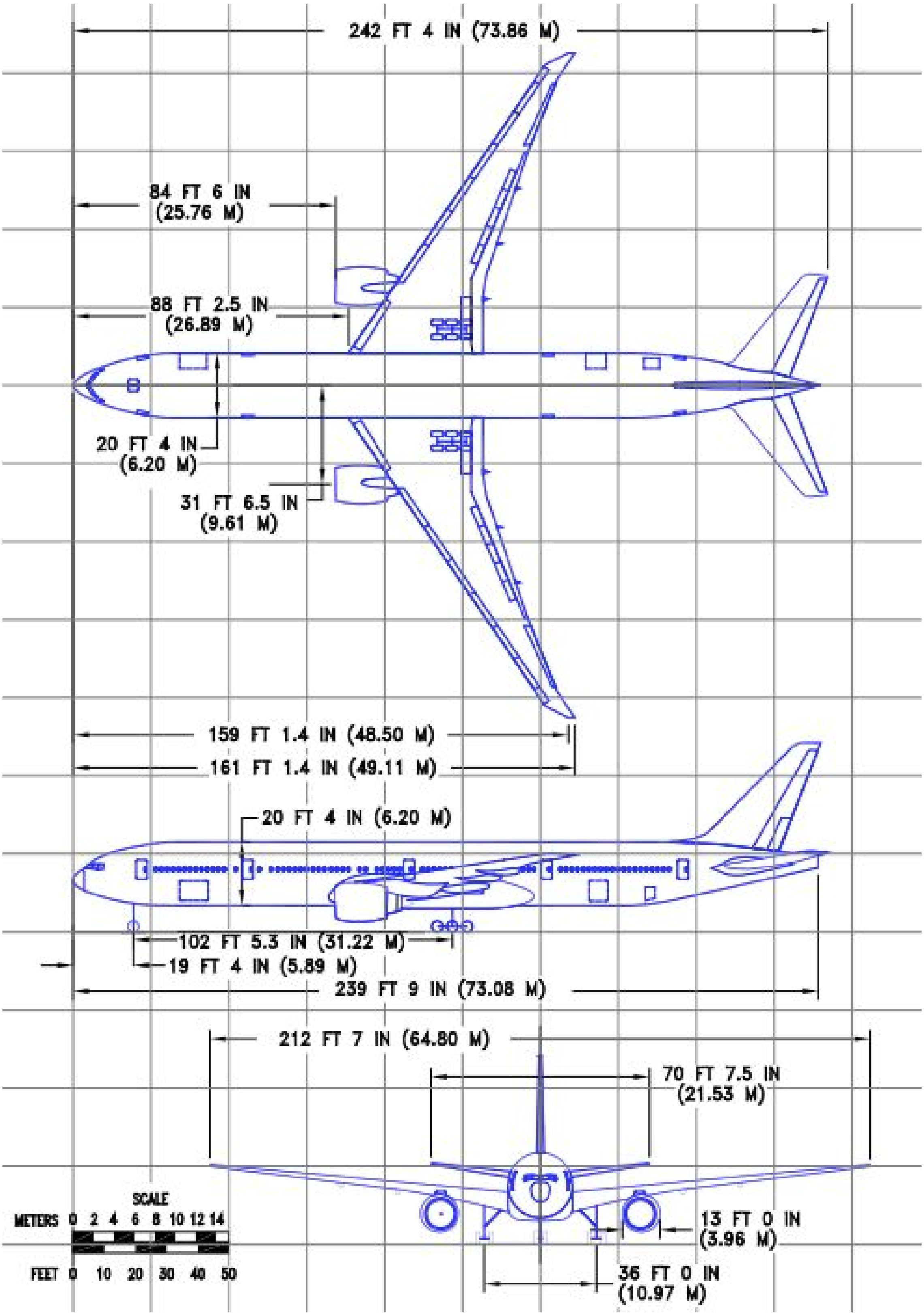

Figure 2.2.4: Boeing 777-300ER dimensions.

	Code element 1		Code element 2	
Code number (1)	Aeroplane reference field length (2)	Code letter (3)	Wingspan (4)	Outer main gear wheel span[a] (5)
1	Less than 800 m	A	Up to but not including 15 m	Up to but not including 4.5 m
2	800 m up to but not including 1 200 m	B	15 m up to but not including 24 m	4.5 m up to but not including 6 m
3	1 200 m up to but not including 1 800 m	C	24 m up to but not including 36 m	6 m up to but not including 9 m
4	1 800 m and over	D	36 m up to but not including 52 m	9 m up to but not including 14 m
		E	52 m up to but not including 65 m	9 m up to but not including 14 m
		F	65 m up to but not including 80 m	14 m up to but not including 16 m

a. Distance between the outside edges of the main gear wheels.

Figure 2.2.5: Reference code given by the OACI.

Due to the RFL being higher than 1800m , the reference number of the runway is number 4 according to OACI and due to the dimensions of the airplane B777-300ER, which has a span of 64,8m<65m and a distance between the landing gear of 10,97m<14m, the letter that defines the airport is E.

2.2.1.3 Runway width and shoulders

The runway width is obtained using the OACI recommendations stated on the Annex 14 and the key reference of the runway.

	Code letter					
Code number	A	B	C	D	E	F
1[a]	18 m	18 m	23 m	–	–	–
2[a]	23 m	23 m	30 m	–	–	–
3	30 m	30 m	30 m	45 m	–	–
4	–	–	45 m	45 m	45 m	60 m

Figure 2.2.6: Runway width according to OACI.

As it can be seen, and remembering that our key reference is 4E, the minimum runway width needed is 45m. This value has to be further increased with the use of runway shoulders up to a minimum of 60m.

2.2.1.4 Declared distances

The calculations done in order to obtain the final value can be seen on the airside's attachments section 1.

To sum up, the final values obtained are:

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